DESKTOP STUDY (PHASE 1)

PALAEONTOLOGICAL IMPACT ASSESSMENT

(REQUIRED UNDER SECTION 38(8) OF THE NHRA (No. 25 OF 1999)

FOR THE PROPOSED VODACOM PTY LTD 22 KV POWERLINE, DINGLETON, GAMAGARA LOCAL MUNICIPALITY, NORTHERN CAPE

Type of development:

Powerline

Client:

Eskom Holding SOC Limited

Client info:

Tshegofatso Nnene

E – mail:

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Developer:

ESKOM MOU

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Report date: October 2020

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APPROVAL PAGE

Project Name	Vodacom Pty Ltd 22 kV Powerline in Dingleton, Gamagara Local Municipality, Northern Cape
Report Title	Heritage Impact Assessment for the Proposed Vodacom Pty Ltd 22 kV Powerline in Dingleton, Gamagara Local Municipality, Northern Cape
Authority Reference Number	SAHRA Case ID 15036
Applicant Name	Eskom Holdings SOC Limited

	Name	**Qualifications and Certifications**	**Date**
Paleontologist	Prof Marion Bamford	PhD in Palaeobotany	October 2020

Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 31 years research; 23 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of 1World Consulting, Westville, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A palaeontological Impact Assessment was requested for the planned Vodacom 22kV power line, near Kathu, Northern Cape Province by SAHRA (Case ID:15036).

To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed project.

The planned route lies on the chert breccias of the uppermost Ghaap Plateau Group (Transvaal Supergroup), and the ferruginised arenites of the Gamagara Formation (Olifantshoek Supergroup). Although indicated as very highly to moderately sensitive, respectively, the general interpretation by SAHRIS is not supported by the detailed geological mapping, and fossils are unlikely to occur in the site. Nonetheless, there is a very small chance that trace fossils such as stromatolites may occur in the adjacent dolomites of the Campbell Rand Group so a Fossil Chance Find Protocol should be added to the EMPr: if trace fossils are found once excavations for pole foundations have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

Table of Contents

1. Background

In a Response to NID dated 03/04/2020, SAHRA (Case ID:15036) requested that a Palaeontological Impact Assessment (as well as an Archaeological Impact Assessment) be submitted for the proposed construction of the 3095 m long, Vodacom (Pty) Ltd 22 kV power line, located in the Kathu area, Northern Cape Province (Figure 1).

A Palaeontological Impact Assessment was completed for this project and is presented herein. To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017)

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	N/A
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4

k	Any mitigation measures for inclusion in the EMPr	Section 7, Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 7, Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

Figure 1: Google Earth map of the proposed Vodacom 22kV line near Kathu with the sections shown by the red and white lines. Map supplied by 1World.

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

3. Geology and Palaeontology

i. Project location and geological context

The Late Archaean to early Proterozoic Transvaal Supergroup is preserved in three structural basins on the Kaapvaal Craton (Eriksson et al., 2006). In South Africa are the Transvaal and Griqualand West Basins, and the Kanye Basin is in southern Botswana. The Griqualand West Basin is divided into the Ghaap Plateau sub-basin and the Prieska sub-basin. Sediments in the lower parts of the basins are very similar but they differ somewhat higher up the sequences. Several tectonic events have greatly deformed the south western portion of the Griqualand West Basin between the two sub-basins

The Transvaal Supergroup comprises one of world's earliest carbonate platform successions (Beukes, 1987; Eriksson et al., 2006; Zeh et al., 2020). In some areas there are well preserved stromatolites that are evidence of the photosynthetic activity of blue green bacteria and green algae. These microbes formed colonies in warm, shallow seas.

The Transvaal Supergroup rocks in the Griqualand West Basin can be correlated with the rocks in the Transvaal Basin, closely according to Beukes and colleagues, or not so closely according to Moore and colleagues. Nonetheless, these rocks represent on a very large scale, a sequence of sediments filling the basins under conditions of lacustrine, fluvial, volcanic and glacial cycles in a tectonically active region. The predominantly carbonaceous sediments are evidence of the increase in the atmosphere of oxygen produced by algal colony photosynthesis, the so-called Great Oxygen Event (ca 2.40 – 2.32 Ga) and precursor to an environment where diverse life forms could evolve. The Neoarchean-Paleoproterozoic Transvaal Supergroup in South Africa contains the well-preserved stromatolitic Campbell

Rand-Malmani carbonate platform (Griqualand West Basin – Transvaal Basin respectively), which was deposited in shallow seawater shortly before the Great Oxidation Event (GOE).

In the Griqualand West Basin the Prieska Sub-basin is to the southwest of the Vryburg Arch and the Ghaap Plateau Sub-basin is to the northeast, with the upper two of four subgroups, the Asbestos Hills Subgroup and the Postmasburg Subgroup of relevance to this project. Comprising a number of lithologies that sometimes grade from one type to another so are difficult to separate, the Ghaap Plateau Group in the Ghaap Plateau Sub-basin is made up of stromatolitic carbonate platforms and dolomites deposited in shallow water or peritidal flats in the Campbell Rand Subgroup (Eriksson et al., 2006). The overlying Asbestos Hills Subgroup has three successive banded iron formations with the gradation from cherts to iron formation in the basal Kliphuis Formation, macro banded iron in the Kuruman Formation and reworked iron formation in the upper Danielskuil Formation (ibid).

Banded ironstone of the Kuruman Formation (Figure 2; Vak) is mined at Sishen and this is the main outcrop in the section for the Vodacom powerline. The route of the powerline is on the uppermost chert breccia of the Ghaap Plateau Group (Figure 2, dark-grey Vgd) with small outcrops of Kuruman Formation jaspillite and chert (dark orange; Vak).

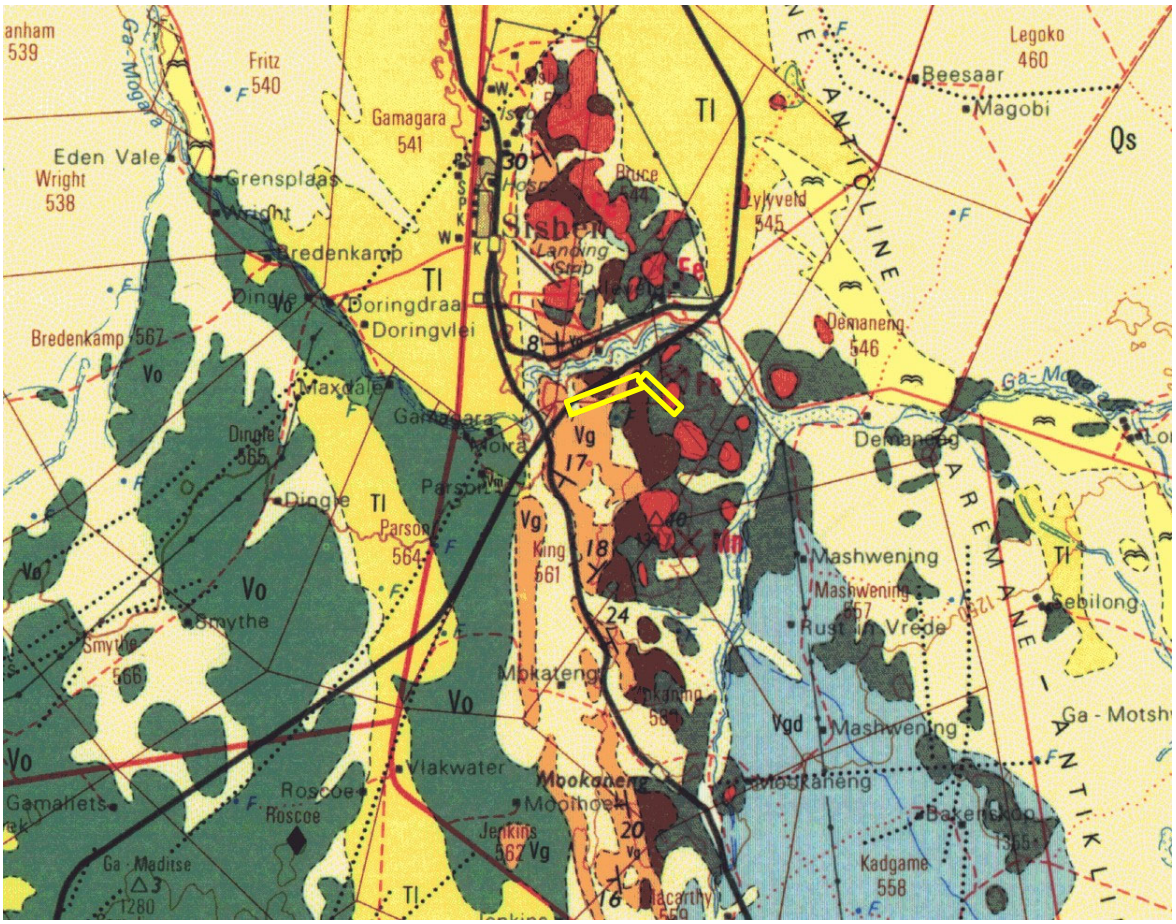

Figure 2: Geological map of the area around Kathu and Sishen. The powerline route is with the yellow lines. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2722 Kuruman.

Table 2: Explanation of symbols for the geological map and approximate ages (Fairey et al., 2013; Moen, 2006; Zeh et al., 2020). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Kalahari Group	Alluvium, sand,	Neogene, ca 2.5 Ma to present
Tl	Kalahari Group	Surface limestone and sands	Tertiary-Quaternary
Vg	Gamagara Fm, Olifantshoek SG	Shale with interbedded quartzite and basaltic lava	<2222 Ma
Vo	Ongeluk Fm, Voelwater Subgroup, Postmasburg Group, Griqualand West Transvaal SG	Andesitic lavas	Ca 2222 Ma
Vm	Makganyene Fm, Voelwater Subgroup, Postmasburg Group, Griqualand West Transvaal SG	Glacial diamictites	Ca 2222 Ma
Vgd	Ghaap Plateau Group, Griqualand West Transvaal SG; Vgh 6 = uppermost chert breccia	undifferentiated	Ca 2521 – 2300 Ma
Vak	Kuruman Fm, Asbestos Hills Subgroup, Ghaap Plateau Group, Griqualand West Transvaal SG	Micro-banded iron formation Jaspillite and chert	Ca 2460 Ma

Overlying the Transvaal Supergroup are the non-fossilferous ferruginised shales and quartzites of the Gamagara Formation, basal Olifantshoek Supergroup. This arenaceous unit is considered to have been deposited as a fluvial clastic wedge along the western margin of the Griqualand West Basin (Moen, 2006).

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 3. The route for the powerline is on a short section of chert breccia of the uppermost Ghaap Plateau Group. According to the geological map 2722 Kuruman, this area has not been recorded as any particular formation within the group. The SAHRIS palaeosensitivity map however, following the Palaeotechnical Report for the Northern Cape (Almond and Pether, 2009), indicates the entire Ghaap Plateau Group as very highly sensitive. Based on the detailed geological map this section does not have potentially fossiliferous stromatolites or dolomites and is recorded as chert breccia. Chert is microcrystalline quartz and breccia is a term used for clastic sedimentary rocks that are composed of large angular fragments (over two millimeters in diameter). The spaces between the large angular fragments are filled with a

matrix of smaller particles and a mineral cement that binds the rock together. In other words, this is not a fossiliferous lithotype at all.

The Gamagara Formation is arenaceous (sandy) but there is no geological record of any fossils occurring in it. Almond and Pether (2009) classify this lithology as non-fossiliferous (blue) but state that stromatolites are possible. Therefore, the moderately sensitive designation is contradictory.

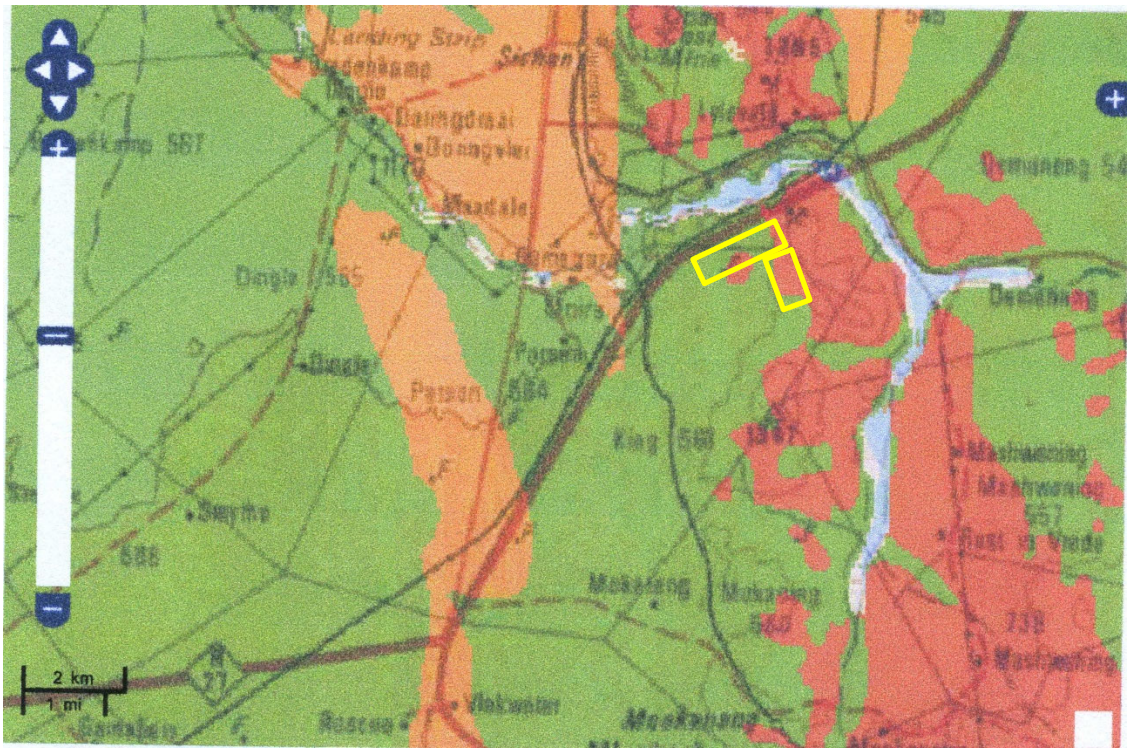

Figure 3: SAHRIS palaeosensitivity map for the site for the proposedVodacom 22kV line near Kathu shown within the yellow rectangles. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above the area is indicated as very highly sensitive (red) for the entire Ghaap Plateau Group, and moderately sensitive (green) for the Gamagara Formation of the Olifantsfontein Supergroup. As explained above neither of these interpretations is clear but based on the geological record, and lack of fossils recorded, it seems very unlikely that fossils would occur.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:

TABLE 3A: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

TABLE 3B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	Chert breccias do not preserve fossils and there are no records of fossils from the arenites of the Gamagara Fm; so it is very unlikely that fossils occur on the site. The impact would be very unlikely.
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since the only possible fossils within the area would be trace fosss of stromatolites from the nearby Campbell Rand, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	-
	M	-
	L	It is extremely unlikely that any fossils would be found in the arenites or the chert breccias. Nonetheless a Fossil Chance Find protocol should be added to the eventual EMPr.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are either much too old to contain fossils or of the wrong type. Furthermore, the excavations for

foundations for poles are very small footprints and well-spaced out so the impact would be extremely small. Since there is an extremely small chance that fossils from the nearby Campbell Rand Group may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and do contain trace fossils of stromatolites, however chert breccias and ferruginised arenites do not preserve fossils. The SAHRIS palaeosensitivity map does not correlate with the detailed geological forms, only with general interpretations so it is very unlikely that trace fossils occur in the power line route, or in the foundation footprints.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, and the rather general interpretations used by SAHRIS, it is extremely unlikely that any fossils would be preserved in the chert breccias of the uppermost Ghaap Plateau Group (Transvaal Supergroup), or the ferruginised arenites of the Gamagara Formation (Olifantshoek Supergroup). There is a very small chance that trace fossils such as stromatolites may occur in the adjacent dolomites of the Campbell Rand Group so a Fossil Chance Find Protocol should be added to the EMPr: if trace fossils are found once excavations for pole foundations have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

7. References

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8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations / drilling activities begin.

1. The following procedure is only required if fossils are seen on the surface and when excavations for foundations commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (stromatolites, trace fossils of invertebrates) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 4, 5). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A – Examples of fossils from the Malmani and Campbell Rand Subgroups, Transvaal Supergroup.

Figure 4: Stromatolites as seen from the surface (from the Malmani Subgroup).

Figure 5: examples of stromatolites, a - in the field in side view; b – surface view in the field; c – side view in section. (Photographs from MacRae, 1999. Life Etched in Stone. Geological Society of South Africa, Johannesburg.).